

AMINO-FUNCTIONAL COMPOUNDS AS BUILDER/DISPERSANTS IN DETERGENT COMPOSITIONS

FIELD OF THE INVENTION

The present invention relates to compounds which can be used as builders, combined builder/dispersants and/or dispersants in detergent compositions. The compounds herein are particularly useful in liquid and granular heavy-duty laundry compositions.

1. Background of the Invention

Compositions useful as builders, dispersants or sequestrants are well-known in the art and have widely ranging chemical compositions. See, for example, Berth et al, *Angew. Chem. Internat. Edit.*, Vol. 14, 1975, pages 94-102. Users of commercially available detergents recognize the utility of such materials in the laundry. It is difficult and somewhat arbitrary to categorize the useful compounds by names such as "builder", "dispersant" or "sequestrant", since many art-disclosed compounds have varying combinations of these useful properties, and are widely used in commerce for many purposes, including boiler scale control and water-softening. Nonetheless, experts in the art recognize that such terms reflect real differences in the properties of the compounds; certain compounds, for example, being distinctly better when used at high levels in a builder function, and others, such as polyacrylates, being better in a low-usage role of dispersant. See, for example, P. Zini, "The Use of Acrylic Based Homo- and Copolymers as Detergent Additives", *Seifen-Öle-Fette-Wachse*, Vol. 113, 1987, pages 45-48 and 187-189. The search for economical new materials having desirable combinations of such attributes thus continues, and the most effective test of their utility is in the simple operation of laundering fabrics.

2. Background Art

Recent disclosures of interest include that of U.S. Pat. Nos. 4,021,359, Schwab, issued May 3, 1977 and 4,680,339, Fong, issued July 14, 1987. See also Abe et al, *Yukagaku* 35(11): 937-944, 1986 and Tanchuk et al, *Ukr. Khim. Zh. (Russ. Ed.)*, 43(7), 1977, pages 733-8. Schwab discloses compounds comprising water-soluble salts of partial esters of maleic anhydride and polyhydric alcohols containing at least three hydroxy groups, which sequester and retard the precipitation of calcium ions and function as detergent builders. Fong reveals a process for the synthesis of water-soluble carboxylated polymers having randomly repeated amide polymer units. Tanchuk et al disclose certain monoesters of N-(β-hydroxyethyl) aspartic acid, derived by reacting butenedioate monoester with ethanolamine.

Abe et al disclose variants of polymalic acid prepared by ring-opening polymerization of benzyl malolactonate and by direct polymerization of DL-malic acid in dimethylsulfoxide. The detergent builder utility of polymalic acid and biodegradability test results are also disclosed.

The chemistry of maleic anhydride has been comprehensively reviewed. See "Maleic Anhydride", B. C. Trivedi and B. M. Culbertson, Plenum Press, New York, 1982, incorporated herein by reference. Desirably for the large-scale manufacture of laundry detergent chemicals, this compound is available in quantity. Trivedi and Culbertson and the above-referenced Schwab patent make it clear that the reactions of maleic anhydride with alcohols are known in the art. How-

ever, the further functionalization of such compounds in the manner of the present invention is apparently unexplored.

As can be seen from the foregoing and as is well-known from the extensive literature relating to laundry detergents, there is a continuing search for improved builders and dispersants. In particular, it would be advantageous to have builders and/or dispersants which can be prepared from readily-available reactants which are biodegradable.

The present invention provides a new class of builder/dispersant materials which help fulfill these needs.

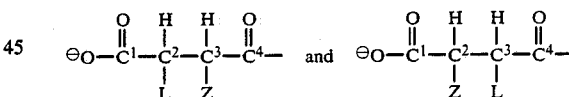
SUMMARY OF THE INVENTION

The present invention encompasses compounds of the formula (MAO)_nE wherein: n is an integer from 1 to about 2,500; M is H or a salt-forming cation (preferably sodium); A is selected from the group consisting of 2-(sec-substituted-amino)-4-oxobutanoate, 2-(tert-substituted-amino)-4-oxobutanoate, 3-(sec-substituted-amino)-4-oxobutanoate and 3-(tert-substituted-amino)-4-oxobutanoate. O is oxygen covalently bonded to E; and E is a particular organic moiety, defined in detail hereinafter.

The terms "sec-substituted-amino" and "tert-substituted-amino" are here used to emphasize that the oxobutanoate derivatives encompassed contain secondary or tertiary amino groups and generally exclude oxobutanoates substituted by primary amino groups, i.e., H₂N-. Compounds of the invention are thus substituted aminooxobutanoates and not H₂N-substituted oxobutanoates.

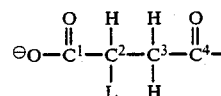
A preferred category of materials provided herein encompasses compounds or isomeric mixtures of compounds wherein the A moiety is selected from $\ominus\text{OC}(\text{O})\text{C}(\text{L})\text{HCH}_2(\text{O})\text{C}-$, $\ominus\text{OC}(\text{O})\text{CH}_2\text{C}(\text{L})\text{H}(\text{O})\text{C}-$ and mixtures thereof, wherein L is a moiety comprising a single secondary or tertiary amino group, provided that when L is ethanolamino, n is greater than 1.

More generally, A moieties can have either of the isomeric formulae



wherein the four carbon atoms of the oxobutanoate chain are numbered as shown and wherein an amino-nitrogen atom of a moiety L, now containing one or more secondary or tertiary amino groups, forms a nitrogen-carbon bond to the carbon atom C² or C³.

In the isomer formulae of A, Z is typically hydrogen, hydrocarbyl or another neutral, chemically unreactive group, essential only for the purpose of completing the valencies. Preferably, as noted, Z is H and the A moieties are 2-L-substituted moieties of formula



As indicated in further detail hereinafter, isomeric mixtures of compounds having a major proportion of these preferred C²-L, C³-H substituted A moieties and a minor proportion of C²-H, C³-L substituted A moieties,